# RF137

## *Transceiver For GSM Applications*

The RF137 Transceiver is a highly integrated device optimized for use in single-band or multi-band Global System for Mobile Communications (GSM) applications.

In the receive path, the device consists of selectable gain Intermediate Frequency (IF) amplifiers and an image reject downconverter with differential IF outputs.

In the transmit path, the device consists of an In-Phase and Quadrature (I/Q) modulator and a frequency translational loop designed to perform frequency up-conversion with high output spectral purity. This loop has a phase/frequency detector, a charge-pump, a mixer, and buffers for the required isolation between RF output, Local Oscillator (LO), and IF inputs.

In addition, the RF137 features an on-chip, dual-loop UHF/VHF frequency synthesizer circuit. It includes two sets of reference dividers, phase/frequency detectors, charge pumps, prescalers, main dividers, and control circuits.

The device package and pinout of the RF137 are shown in Figure 1. A block diagram is shown in Figure 2.

The signal pin assignments and functional pin descriptions are found in Table 1. The absolute maximum ratings of the device are provided in Table 2, and the operating conditions and electrical specifications are provided in Table 3.

### Features

- Image-reject mixer for downconversion to 2nd IF
- 24 dB selectable attenuation on 1st IF amplifier
- 12 dB selectable attenuation on 2nd IF amplifier
- Integrated transmit path with high phase accuracy
- Reduced filtering requirements for the transmit path
- Wide RF and IF range for multi-band operation
- Integrated, fully programmable dual loop synthesizer
- Integrated local oscillator phase shifters
- On-chip second local oscillator
- Low supply voltage down to 2.7 V
- Separate enable lines for transmit, receive, and synthesizer modes for power management
- 48-pin Thin Quad Flat Pack (TQFP) (7mm x 7mm) package

### Applications

- GSM900/DCS1800/PCS1900 digital cellular telephony

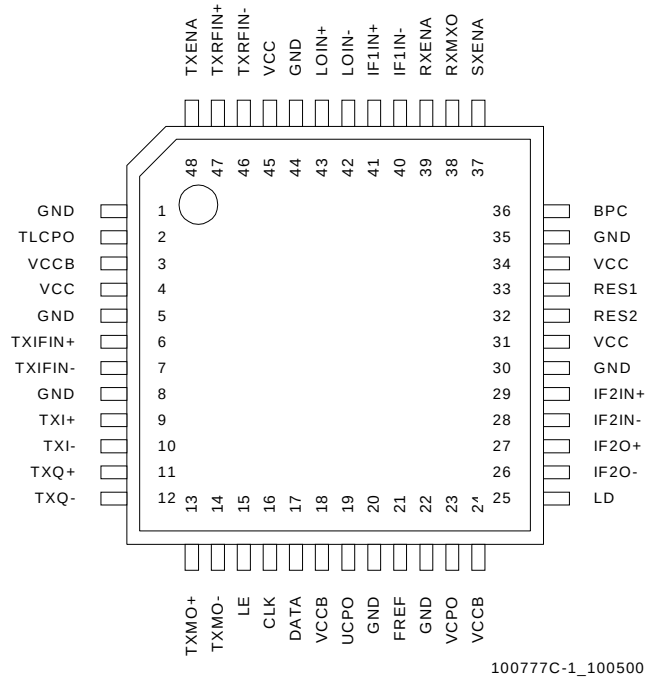



**Figure 1. RF137 Pinout – 48-Pin TQFP**

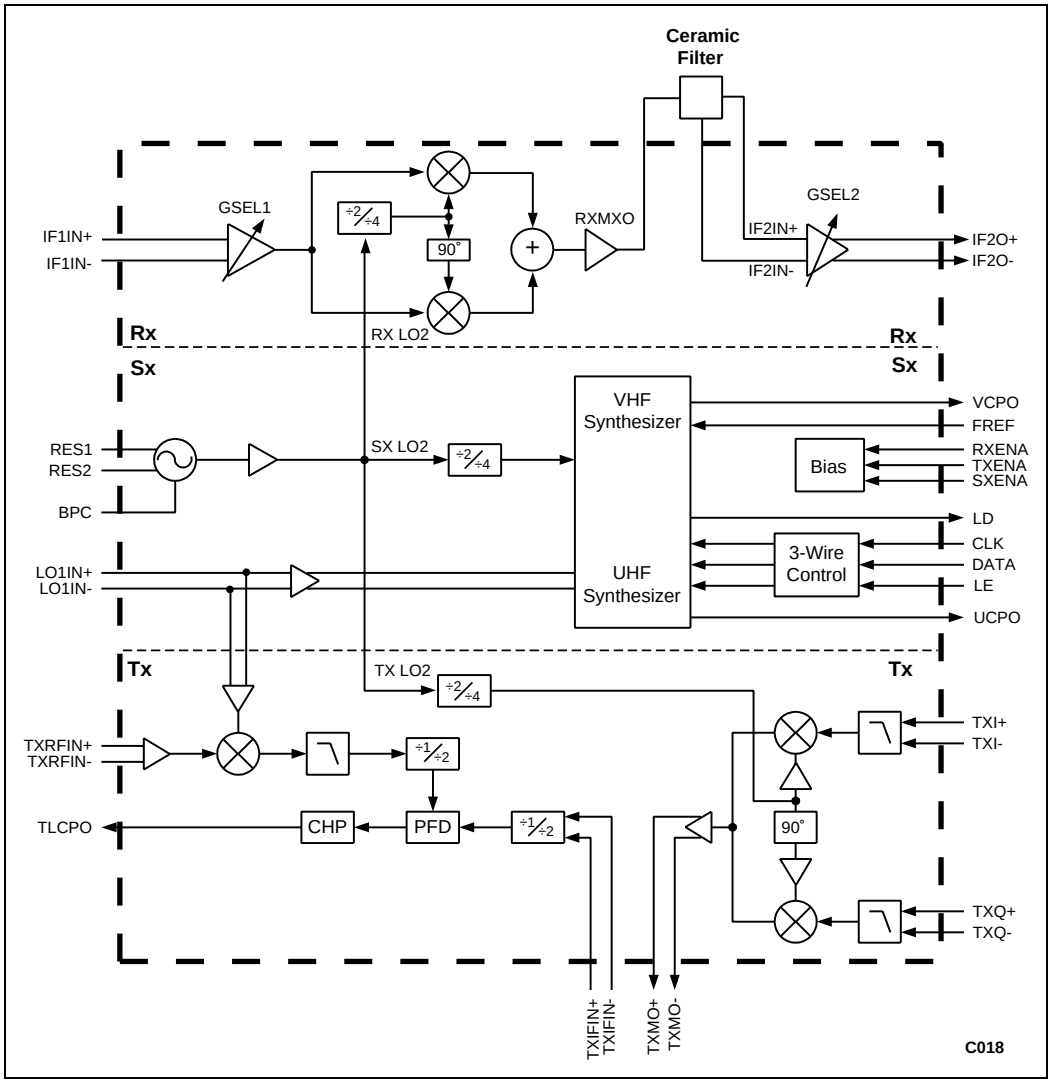



**Figure 2. RF137 Block Diagram**

## Technical Description

The RF137 Transceiver consists of three main sections:

- Receive (Rx) section
- Transmit (Tx) section
- Synthesizer (Sx) section

The Rx, Tx, and Sx sections can be powered up or down independently by setting RXENA, TXENA, and SXENA high or low.

The signal pin assignments and functional pin descriptions are found in Table 1. Table 2 provides the absolute maximum ratings of the RF137. The general electrical characteristics are provided in Table 3.

**Receive Section**. The receive section consists of the following functional blocks:

- A first IF amplifier (selectable gain step of 24 dB).
- An image reject mixer that downconverts from a first IF to a second IF.
- A buffer amplifier that precedes a second IF ceramic filter.
- A second IF amplifier (selectable gain step of 12 dB) with differential outputs.

The first IF amplifier is a Programmable Gain Amplifier (PGA) with selectable gains of +18 or –6 dB. The amplifier gain is controlled by a three-wire bus. The first IF amplifier is at a high gain state when bit S7 = 1 (Rx Gain Sel1) and CO = 1 or at a low gain state when bit S7 = 0 (Rx Gain Sel1) and CO = 1.

The image reject mixer relaxes the first IF filtering requirements at the image frequency of the second mixer. Image rejection is achieved for a high side/low side injection when bit S9 is set to the appropriate logic level and CO = 1. Table 4 defines the three-wire bus control and output states.

**Table 1. RF137 Signal Description**

| Pin # | Name | Description | Pin # | Name | Description |
|---|---|---|---|---|---|
| 1 | GND | Ground | 25 | LD | Lock detect output |
| 2 | TLCPO | Translational loop charge pump output | 26 | IF2O– | 2nd IF output |
| 3 | VCCB | Supply for synthesizers | 27 | IF2O+ | 2nd IF output |
| 4 | VCC | Supply for transceiver | 28 | IF2IN– | 2nd IF input reference |
| 5 | GND | Ground | 29 | IF2IN+ | 2nd IF input |
| 6 | TXIFIN+ | TxIF translation loop input | 30 | GND | Ground |
| 7 | TXIFIN– | TxIF translation loop input | 31 | VCC | Supply for transceiver |
| 8 | GND | Ground | 32 | RES2 | Resonator pin for VHF oscillator |
| 9 | TXI+ | Tx modulator input | 33 | RES1 | Resonator pin for VHF oscillator |
| 10 | TXI– | Tx modulator input | 34 | VCC | Supply for transceiver |
| 11 | TXQ+ | Tx modulator input | 35 | GND | Ground |
| 12 | TXQ– | Tx modulator input | 36 | BPC | Bypass capacitor |
| 13 | TXMO+ | Positive polarity TX modulator output | 37 | SXENA | Synthesizer enable |
| 14 | TXMO– | Negative polarity TX modulator output | 38 | RXMXO | Rx mixer output |
| 15 | LE | Latch enable input | 39 | RXENA | Receiver enable |
| 16 | CLK | Clock input | 40 | IF1IN– | 1st IF input |
| 17 | DATA | Data input | 41 | IF1IN+ | 1st IF input |
| 18 | VCCB | Supply for synthesizers | 42 | LOIN– | UHF local oscillator input reference |
| 19 | UCPO | UHF loop charge pump output | 43 | LOIN+ | UHF local oscillator input |
| 20 | GND | Ground | 44 | GND | Ground |
| 21 | FREF | Reference input | 45 | VCC | Supply for transceiver |
| 22 | GND | Ground | 46 | TXRFIN– | Transmit input reference |
| 23 | VCPO | VHF loop charge pump output | 47 | TXRFIN+ | Transmit input |
| 24 | VCCB | Supply for synthesizers | 48 | TXENA | Transmit enable |

**Table 2. Absolute Maximum Ratings**

| Parameter | Minimum | Maximum | Units |
|---|---|---|---|
| Ambient Operating Temperature | –30 | +85 | °C |
| Storage Temperature | –40 | +125 | °C |
| Power Dissipation | | +600 | mW |
| Supply Voltage ($V_{CC}$) | | +4.0 | V |
| Input Voltage Range | GND | Vcc | V |
| Supply Voltage ($V_{CCB}$) | | 4.0 | V |

**Table 3. RF137 Electrical Specifications (1 of 4)**
**(TA = 25 °C, Vcc = 3.0 V, except where specified)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| **IF Amplifier/Mixer** | | | | | | |
| Input impedance | ZIN | differential | | 1000// 0.5 | | Ω//pF |
| Input operating frequency | FN | | 70 | | 450 | MHz |
| Voltage gain:<br>High gain mode<br>Low gain mode | AV | <br>S7 = 1, CO = 1<br>S7 = 0, CO = 1 | <br>+16.5<br>–7 | <br>+18<br>–6 | <br>+19<br>–5 | <br>dB<br>dB |
| Gain step variation | dAV | | | | 0.5 | dB |
| Single-sideband noise figure | NF | High gain mode | | 7 | 8 | dB |
| Input 1 dB compression point<br>High gain mode<br>Low gain mode | P1dB | | <br>–35<br>–9 | <br>–32<br>–7 | | <br>dBV<br>dBV |
| Mixer spurious level | | Pin = –51 dBV | | | –50 | dBc |
| Image rejection | | | 35 | 45 | | dB |
| Output impedance | ZOUT | | | 330// 2.2 | | Ω//pF |
| Output operating frequency | FOUT | | | 14.6 | | MHz |
| **2nd IF Amplifier** | | | | | | |
| Input impedance | ZIN | | | 330// 2.2 | | Ω//pF |
| Operating frequency | FIF | | | 14.6 | | MHz |
| Voltage gain:<br>High gain mode<br>Low gain mode | AV | <br>S8 = 1, CO = 1<br>S8 = 0, CO = 1 | <br>17<br>5 | <br>18<br>6 | <br>19<br>7 | <br>dB<br>dB |
| Gain step variation versus frequency | dAV | | | | 0.5 | dB |
| Noise figure | NF | | | 7 | | dB |
| Input P1dB | P1dB | low gain mode | –25 | –22 | | dBV |
| Output impedance | ZOUT | differential | | 1000// 1.2 | | Ω//pF |
| **Receiver** | | | | | | |
| Gain temperature coefficient | | without ceramic filter | | 0.03 | 0.04 | dB/°C |
| Power supply rejection ratio | | | | 0.5 | | dB/V |
| Input common mode rejection ratio | | FIN = 400 MHz | | 65 | | dB |
| **I/Q Modulator** | | | | | | |
| Input impedance | ZIN | differential @ 100 kHz | | 750// 3.3 | | kΩ//pF |
| Input common mode voltage range | VCM | | 0.85 | 1.35 | VCC– 1.35 | V |
| Input offset voltage | VOS | | | 1 | 5 | mV |
| Input common mode rejection ratio | | FIN = 100 kHz<br>FIN = 1 MHz | | 75<br>55 | | dB |
| Output operating frequency | FOUT | | 70 | | 425 | MHz |
| Output impedance | ZOUT | differential @400MHz | | 600// 3.1 | | Ω//pF |

**Table 3. RF137 Electrical Specifications (2 of 4)**
**(TA = 25 °C, Vcc = 3.0 V, except where specified)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| **I/Q Modulator (continued)** | | | | | | |
| Differential output voltage | | | –20 | –15 | | dBV |
| Output noise power | NO | 10 MHz offset | | –130 | –126 | dBc/Hz |
| LO feedthrough | | | | –43 | –40 | dBc |
| Sideband suppression | | | | 45 | | dB |
| Spurious (Note 1) | | <br>@200 kHz offset<br>@300 kHz offset | | <br>–60<br>–60 | <br>–40<br>–45 | <br>dBc<br>dBc |
| **Translational Loop** | | | | | | |
| Transmit frequency (input from VCO) | fTX | | 800 | | 2000 | MHz |
| LO input frequency | fLO | | 800 | | 2000 | MHz |
| IF frequency:<br>with divide-by-2<br>with divide-by-1 | fIF | <br>S4 = 1, CO = 1<br>S4 = 0, CO = 1 | <br>70<br>70 | | <br>425<br>300 | MHz |
| Transmit input power | PIN | with external 50Ω termination | –13 | –10 | –7 | dBm |
| Transmit input impedance | ZIN | differential | | 300// 0.3 | | Ω<br>pF |
| LO input power | PIN | With external 50Ω termination | –13 | –10 | –7 | dBm |
| LO input impedance | ZIN | differential | | 300// 0.3 | | Ω<br>pF |
| Tx output noise | NO | @ 20 MHz offset (Note 2) | | –165 | –162 | dBc/Hz |
| Charge pump output current<br>source/sink<br>source/sink<br>high impedance output | IOUT | <br>S10 = 0, CO = 1<br>S10 = 1, CO = 1 | | <br>±1.0<br>±0.5<br>0.02 | | <br>mA<br>mA<br>mA |
| Tx output spurs (Note 3):<br>2X spurs<br>3X spurs<br>4X spurs<br>5X spurs | | | | <br>–65<br>–70<br>–70<br><–70 | | <br>dBc<br>dBc<br>dBc<br>dBc |
| Device turn-on and lock time (with respect to enable input) | | 1 MHz loop bandwidth | | 30 | 100 | µs |
| **VHF VCO** | | | | | | |
| Operating frequency (depends on external resonator) | FVCO | | 300 | | 850 | MHz |
| Tuning voltage range:<br>varactor ground referenced<br>varactor supply referenced | | | 0.5 | | <br>VCC–<br>0.5 | <br>V<br>V |
| Phase noise (Note 4) | | 10 MHz offset, FVCO = 800 MHz, resonator Q = 20 | | –145 | | dBc/Hz |

**Table 3. RF137 Electrical Specifications (3 of 4)**

**($T_A$ = 25 °C, Vcc = 3.0 V, except where specified)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| **Synthesizer** | | | | | | |
| Input frequency (low freq. mode), VHF PLL | fINL(IF) | | 150 | | 260 | MHz |
| Input frequency (high freq. mode), VHF PLL | fINH(IF) | | 250 | | 450 | MHz |
| Input frequency (low freq. mode), UHF PLL | fINL(RF) | | 500 | | 1200 | MHz |
| Input frequency (high freq. mode), UHF PLL | fINH(RF) | | 500 | | 2000 | MHz |
| Reference frequency | fREF | | 1 | | 40 | MHz |
| Reference input sensitivity | RIN | | 500 | | | mVpp |
| Phase detector frequency | fPD | | 10 | | 10000 | kHz |
| Phase detector output impedance | ZO | | 10 | | | MΩ |
| Prescaler input sensitivity | PIN | | 100 | | | mVpp |
| Prescaler input impedance | ZIN | @ 1 GHz | | 100 | | Ω |
| PLL contribution to phase jitter (N=11670) | $\Phi_{NMAIN}$ | UHF only; Fcomparison = 100 kHz, 10 kHz loop BW; integrated from 200 to 270,000 Hz | | 1.5 | | Degrees RMS |
| Main divider phase jitter | $\Phi_{DIV}$ | | | | 0.5 | ps |
| PLL contribution to phase jitter (N=1680) | $\Phi_{NAUX}$ | VHF only; Fcomparison = 300 kHz, 10 kHz loop BW; integrated from 200 to 270,000 Hz | | 0.75 | | Degrees RMS |
| UHF charge pump current, step 0 | $I_{DOR,0}$ | t=25°C | 0.6 | 0.8 | 1.0 | mA |
| UHF charge pump current, step 1 | $I_{DOR,1}$ | t=25°C | 0.9 | 1.2 | 1.5 | mA |
| UHF charge pump current, step 2 | $I_{DOR,2}$ | t=25°C | 1.35 | 1.8 | 2.25 | mA |
| UHF charge pump current, step 3 | $I_{DOR,3}$ | t=25°C | 2.02 | 2.7 | 3.38 | mA |
| VHF charge pump current, step 0 | $I_{DOI,0}$ | t=25°C | 0.4 | 0.5 | 0.67 | mA |
| VHF charge pump current, step 1 | $I_{DOI,1}$ | t=25°C | 0.6 | 0.8 | 1.0 | mA |
| VHF charge pump current, step 2 | $I_{DOI,2}$ | t=25°C | 0.9 | 1.2 | 1.5 | mA |
| VHF charge pump current, step 3 | $I_{DOI,3}$ | t=25°C | 1.35 | 1.8 | 2.25 | mA |
| Charge pump current relative step size (current change from any one step to next step in sequence) | $I_{DOS}$ | | 40 | 50 | 60 | % |
| Charge pump leakage current | IDOO | | –5 | | 5 | nA |
| Charge pump output voltage compliance | VDO | | 0.5 | | Vcc–0.5 | V |
| Lock detect time constant | ILOCK | | | 500 | | µs |
| Lock detect phase error threshold | | | | 45 | | degrees |
| **Three-Wire Control (refer to Figure 4)** | | | | | | |
| Data to clock setup time | tCS | | 50 | | | ns |
| Data to clock hold time | tCH | | 10 | | | ns |
| Clock pulse width high | tCWH | | 50 | | | ns |
| Clock pulse width low | tCWL | | 50 | | | ns |
| Clock to load enable setup time | tES | | 50 | | | ns |
| Load enable pulse width | tEW | | 50 | | | ns |
| Load enable transition to clock start time | tls | | 50 | | | ns |

**Table 3. RF137 Electrical Specifications (4 of 4)**
**($T_A$ = 25 °C, Vcc = 3.0 V, except where specified)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| **Transceiver** | | | | | | |
| Enable and control VIH | VIH | | Vcc–0.4 | | | V |
| Enable and control VIL | VIL | | | | 0.4 | V |
| Enable and control IIH | IIH | | | 20 | 60 | µA |
| Enable and control IIL | IIL | | –10 | –1 | 0 | µA |
| Total supply current: | $I_{CC}$ | | | | | |
| Rx mode | | RXENA = SXENA = high | | 48 | | mA |
| Tx mode | | TXENA = SXENA = high | | 60 | | mA |
| Synthesizer mode | | SXENA = high | | 27 | | mA |
| Sleep mode @Vcc = 3.0V | | RXENA = SXENA = TXENA = low | | 0.04 | 0.2 | mA |
| Power supply range | $V_{CC}$ (Note 5)<br>$V_{CCB}$ | | 2.7<br>2.7 | 3.75<br>3.75 | 3.94<br>3.94 | V<br>V |
| Operating temperature range | $T_A$ | | –30 | +25 | +85 | °C |

**Note 1**: For 1Vp-p, 100 kHz differential signals across Iin and Qin.

**Note 2**: For 1 MHz loop bandwidth and external VCO with phase noise of –165 dBc/Hz @ 20 MHz offset from a carrier frequency of 900 MHz.

**Note 3**: "NX spurs" denotes the order of the fLO harmonic that can mix with a harmonic of fIF and result in a product at zero frequency.

**Note 4**: Using varactors with similar characteristics as Loral part KV1925.

**Note 5**: $V_{CC}$ must not be less than $V_{CCB}$ – 0.4 V if separate supply voltages are used for $V_{CC}$ and $V_{CCB}$.

The buffer amplifier following the image reject mixer has an output impedance of 330 Ω for direct connection to the external ceramic filter.

The second IF amplifier converts the single-ended output from the ceramic filter to a differential signal which may be input to a bandpass sigma-delta A/D converter. The input impedance of the amplifier is a nominal 330 Ω, which matches the external ceramic filter. The nominal gain of the amplifier is 18 dB, but is reduced to 6 dB when bit S8 = 0 (Rx Gain Sel2) and CO = 1.

**Transmit Section**. The transmit section consists of the following functional blocks:

- A baseband to IF quadrature modulator with an output amplifier.
- A translation loop circuit consisting of a phase and frequency detector, a charge pump, a TxRF input buffer, an LO input buffer, a mixer, and a low pass filter.

The I/Q-to-IF modulator takes in differential I and Q baseband signals. The baseband signals are initially low pass filtered and then input to a pair of double balanced mixers. Pins 13 and 14 (TXMO+ and TXMO–, respectively), the modulator output, and Pins 6 and 7 (TXIF+ and TXIF–, respectively), the IF input, allow for any additional filtering required before the signals enter the translation loop.

The translation loop circuit of the RF137, together with a VCO and an external loop filter, forms a Phase-Locked Loop (PLL). The inherent bandpass filtering that occurs in the PLL eliminates the need for a duplexer or a Surface Acoustic Wave (SAW) filter that is usually required to suppress transmission noise. The overall efficiency is increased as a result of the elimination of high loss, post-PA bandpass filters. This results in increased handset talk time.

The VCO output of the translation loop is at the transmit RF frequency. A portion of the VCO output must be fed back to Pin 47 (TXRFIN+) of the device and mixed with a buffered LO signal to create an IF signal. The IF output from the mixer is input to the phase and frequency detector where the IF output from the mixer is compared with the modulated IF input to the device. When CO = 1, the S6 bit on the three-wire bus allows for a high side/low side injection setting.

**Synthesizer Section (Sx)**. The synthesizer section consists of the following functional blocks:

- Frequency synthesizers
- On-chip oscillator with external resonant circuit
- Three-wire bus control circuit

**Table 4. RF137 Control Bits and Output States**

| Block | C0 | Bit | Function | Description |
|---|---|---|---|---|
| LO | 1 | S1 | RX LO ÷2/÷4 | Selects the division ratio for RX LO2 (0 = division ratio is 2; 1 = division ratio is 4) |
| | | S2 | SX LO2 ÷2/÷4 | Selects the division ratio for SX LO2 (0 = division ratio is 2; 1 = division ratio is 4) |
| | | S3 | TX LO ÷2/÷4 | Selects the division ratio for TX LO2 (0 = division ratio is 2; 1 = division ratio is 4) |
| TX | 1 | S4 | TX IF ÷1/÷2 | Selects the division ratio for TX IF (0 = division ratio is 1; 1 = division ratio is 2) |
| | | S5 | TX MIX OUT ÷1/÷2 | Selects the division ratio for TX MIX output signal (0 = division ratio is 1; 1 = division ratio is 2) |
| | | S6 | TX LO Injection | Selects between high-side and low-side injection of first LO input with respect to transmit RF (0 = low side; 1 = high side) |
| Receive | 1 | S7 | RX Gain Select 1 | Selects RX 1st IF amplifier gain (0 = low gain; 1 = high gain) |
| | | S8 | RX Gain Select 2 | Selects RX 2nd IF amplifier gain (0 = low gain; 1 = high gain) |
| | | S9 | RX LO Injection | Selects LO injection (0 = low side injection; 1 = high side injection) |
| TRX | 1 | S10 | TX TL CP Current | Charge pump current in translation loop circuit (0 = low current, 1 = high current) |
| | | S11 | Reserved | S11 bit may be programmed as “don’t care.” |
| | | S12 | VHF LO BUF | Selects the state of LO buffer. Needs to be “1” for correct operation (0 = LO buffer off; 1 = LO buffer on) |
| SX | 0 | S1 | IF/RF | Selects one of the synthesizers, either the VHF or UHF (0 = VHF is selected; 1 = UHF is selected |
| | | S2 | R/N | Selects the R count or N count register within the synthesizer. The N count register also controls the phase detector current and inversion (or phase comparison reference signal) (0 = N counter register selected; 1 = R counter register selected) |
| | | S3 | S2=0: Prescaler frequency response | Determines the maximum input frequency at which the prescaler will operate. S1=1 (UHF): 0 = 1.2 GHz, 1 = 2.0 GHz; S1=0 (VHF): 0 = 260 MHz, 1 = 450 MHz |
| | | | S2=1: Output invert | Controls polarity of charge pump output (0 = normal operation; 1 = inverted) |
| | | S4 | S2=0: Synthesizer power down | Powers down the synthesizers. Only the synthesizer indicated by S1 is affected (0 = Normal operation; 1 = Power down) |
| | | | S2=1: Lock detect/Test mode select | Used to select the test mode or lock detect output on pin 25 (0 = selects the test mode output, where S8 and S9 select the signal multiplexed to pin 25; 1 = selects the translational loop lock detect signal for output to pin 25). |
| | | S5-S22 | S2=0: N counter | This 18-bit value is loaded into the N counter latch. This value sets the cascaded division ratio of the prescaler and N counter (S22=MSB, S5=LSB). For the VHF N divider (16-bit), bits S21 and S22 are “don’t care”.<br>The least significant bits (S5-S9 for UHF N divider; S5-S7 for VHF N divider) set the prescaler counter. |
| | | S5-S6 | S2=1: Output current | These bits set the charge pump output current.<br>S1=1 UHF: 00=0.8, 01=1.2, 10=1.8, 11=2.7 [mA]<br>S1=0 VHF: 00=0.5, 01=0.8, 10=1.2, 11=1.8 [mA] |
| | | S7 | S2=1: CP output impedance | The charge pump output is changed to a high impedance output. Only the charge pump output selected by S1 bit is affected (0 = Normal operation; 1 = output impedance) |
| | | S8-S9 | S2=1, S4 = 0: Test mode | These bits select which signal is output at pin 25 (LD) when the test mode output is selected (S2 = 1, S4 = 0).<br>00 = (Lock detect of VHF) AND (lock detect of UHF)<br>01 = Output of R divider<br>10 = Output of N divider<br>11 = Output of lock detect VHF (S1=0) or UHF (S1=1) |
| | | S10-S22 | S2=1: R counter | These 13 bits set the reference divider value (S22=MSB, S10=LSB). |

There are two frequency synthesizers on the chip, one UHF and one VHF. The UHF synthesizer can provide frequencies from 500 MHz to 2 GHz. It consists of a 32/33 modulus prescaler, a 13-bit R counter, an 18-bit N counter, a phase detector with lock detection, and a charge pump. The VHF synthesizer, with a frequency range from 150 MHz to 450 MHz, consists of an 8/9 modulus prescaler, a 13-bit R counter, a 16-bit N counter, a phase detector with lock detection, and a charge pump. Each synthesizer has four charge pump current settings for optimal performance.

The on-chip oscillator together with a few external components as resonant elements, form a VHF VCO (Figure 3 shows the VCO configuration). The differential VCO output is buffered and then fed to three dividers (Rx, Tx, Sx) with a selectable divide ratio of either 2 or 4. The Rx and Tx dividers are both quadrature dividers, which generates in-phase and quadrature phase LOs.

The on-chip oscillator with the on-chip VHF synthesizer, provides complete VHF frequency synthesis for the Rx VHF LO and Tx VHF LO.

The three-wire bus control allows the RF137 to be optimized for any desired frequency plan. It also programs the two on-chip frequency synthesizers. To ensure that the data remains latched, one of the signals TXENA, RXENA, or SXENA must stay enabled.

When bit C0 is set to 1, it allows for divider selections in the translation loop, high-side/low-side injection for the image reject mixer and the receive IF amplifiers' gain setting. When bit C0 is set to 0, it programs the UHF/VHF synthesizer, the R/N counter, charge pump polarity, charge pump output current, and prescaler setting.

The three-wire bus timing diagram is provided in Figure 4. Figure 5 illustrates a typical RF137 application circuit. Figure 6 provides the package dimensions for the 48-pin TQFP RF137 transceiver and Figure 7 provides the tape and reel dimensions.

## ESD Sensitivity

Because the RF137 is a static-sensitive electronic device, proper ESD precautions must be taken when using the RF137. Do not operate or store the RF137 near strong electrostatic fields.

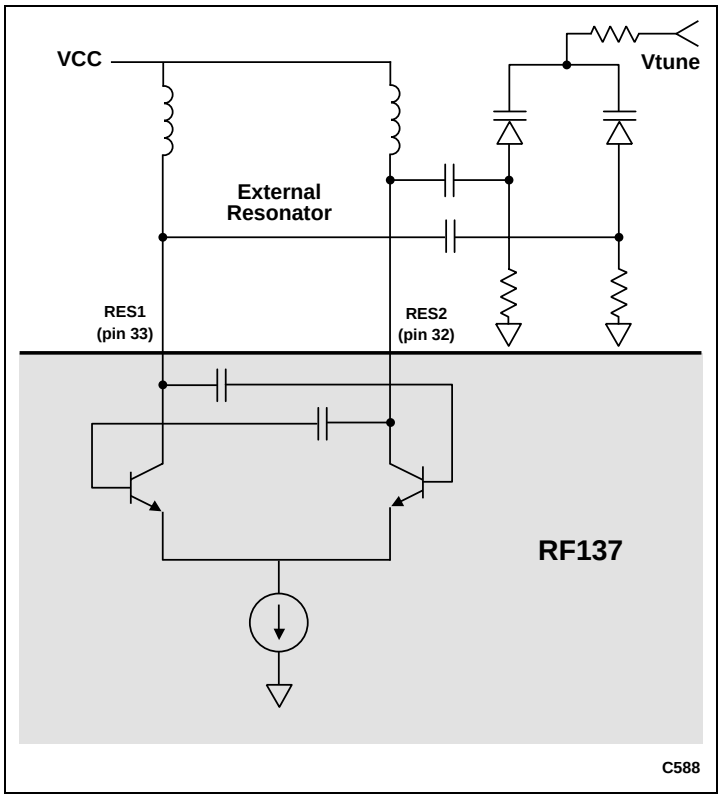



**Figure 3. RF137 Internal VCO**

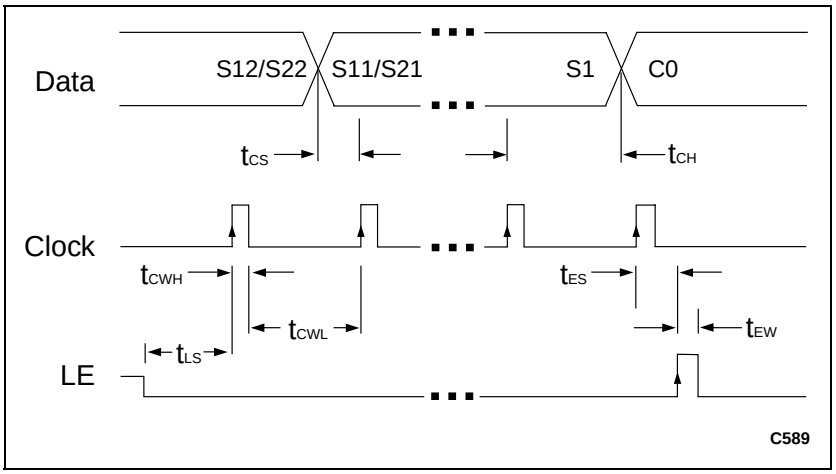



**Figure 4. RF137 Wire Bus Timing Diagram**

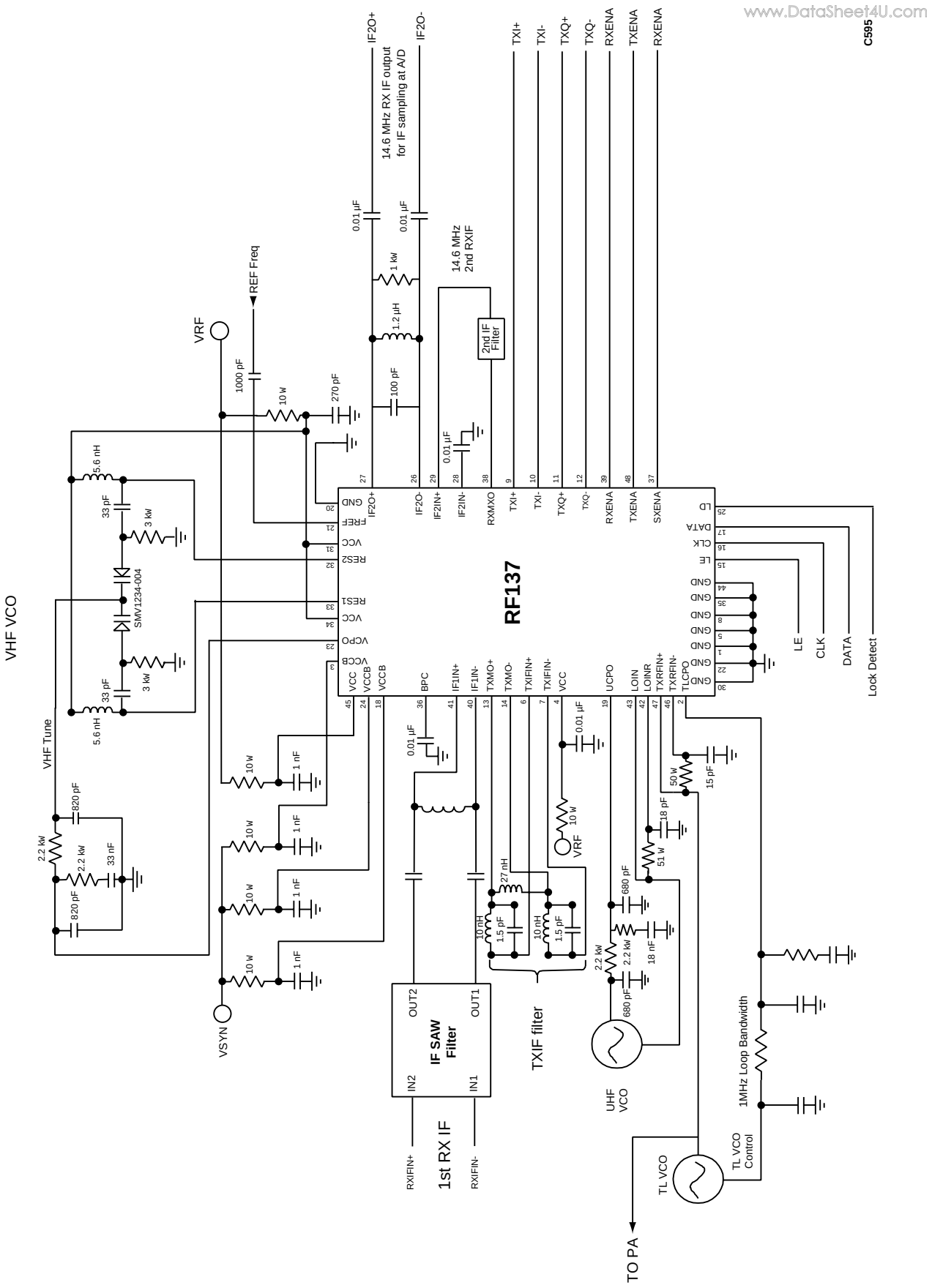
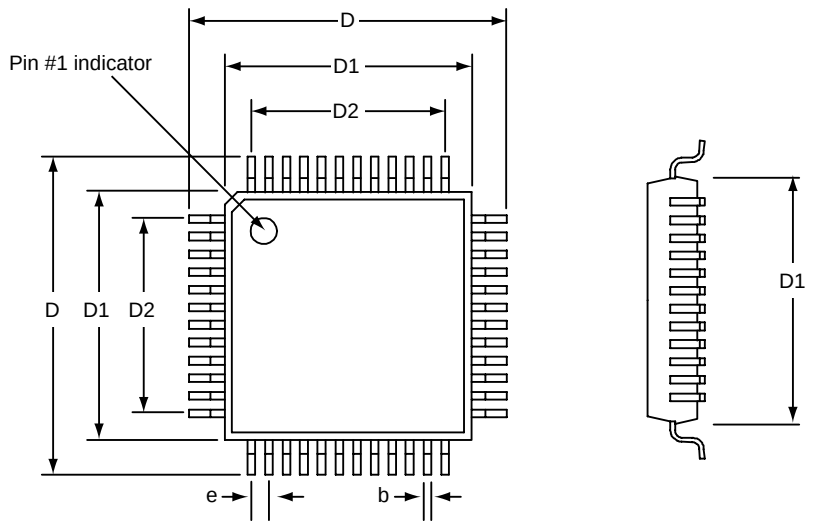
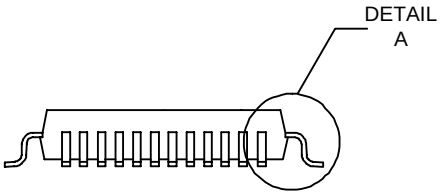
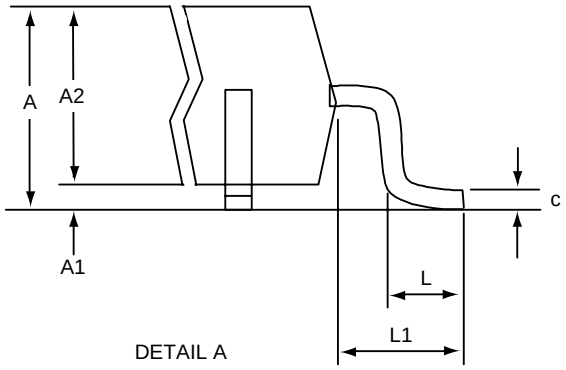



**Figure 5. RF137 Typical Application Schematic**




| Dim. | Millimeters Min. | Millimeters Max. | Inches* Min. | Inches* Max. |
|---|---|---|---|---|
| A | 1.6 MAX | | 0.0630 MAX | |
| A1 | 0.05 | 0.15 | 0.0020 | 0.006 |
| A2 | 1.35 | 1.45 | 0.0528 | 0.0571 |
| D | 8.85 | 9.15 | 0.3484 | 0.3602 |
| D1 | 6.95 | 7.05 | 0.2736 | 0.2776 |
| D2 | 5.5 REF | | 0.2165 REF | |
| L | 0.5 | 0.75 | 0.0197 | 0.0295 |
| L1 | 1.0 REF | | 0.0394 REF | |
| e | 0.500 REF | | 0.0197 REF | |
| b | 0.220 REF | | 0.0087 REF | |
| c | 0.11 | 0.17 | 0.0043 | 0.0067 |
| Coplanarity | 0.10 MAX | | 0.0039 MAX | |
| Ref: 48-PIN TQFP (GP00-D283) | | | | |

* Metric values (millimeters) should be used for PCB layout. English values (inches) are converted from metric values and may contain round-off errors.

C004

**Figure 6. RF137 Package Dimensions – 48-Pin TQFP**

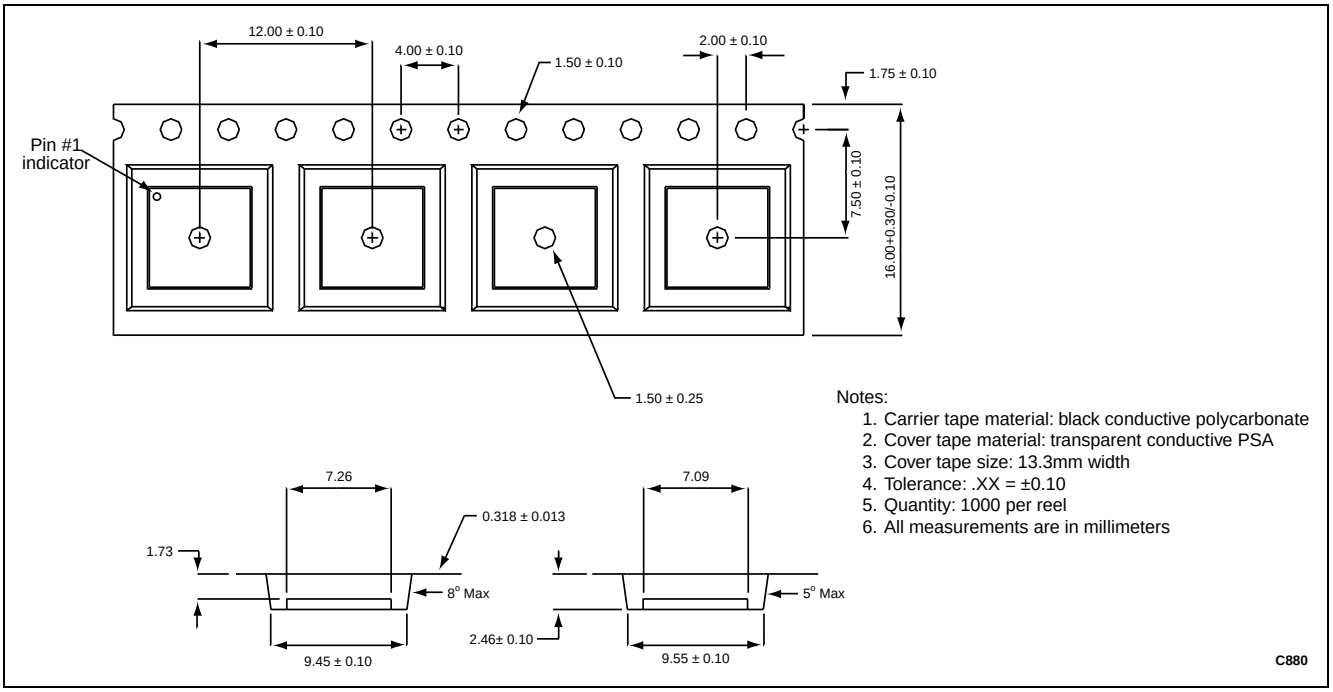



**Figure 7. RF137 Tape and Reel Dimensions**

## Ordering Information

| Model Name | Manufacturing Part Number | Product Revision |
|---|---|---|
| GSM Transceiver | RF137 | |


**Further Information**
literature@conexant.com
(800) 854-8099 (North America)
(949) 483-6996 (International)
Printed in USA

**World Headquarters**
Conexant Systems, Inc.
4311 Jamboree Road
Newport Beach, CA
92660-3007
Phone: (949) 483-4600
Fax 1: (949) 483-4078
Fax 2: (949) 483-4391

**Americas**

**U.S. Northwest/**
Pacific Northwest – Santa Clara
Phone: (408) 249-9696
Fax: (408) 249-7113

**U.S. Southwest – Los Angeles**
Phone: (805) 376-0559
Fax: (805) 376-8180

**U.S. Southwest – Orange County**
Phone: (949) 483-9119
Fax: (949) 483-9090

**U.S. Southwest – San Diego**
Phone: (858) 713-3374
Fax: (858) 713-4001

**U.S. North Central – Illinois**
Phone: (630) 773-3454
Fax: (630) 773-3907

**U.S. South Central – Texas**
Phone: (972) 733-0723
Fax: (972) 407-0639

**U.S. Northeast – Massachusetts**
Phone: (978) 367-3200
Fax: (978) 256-6868

**U.S. Southeast – North Carolina**
Phone: (919) 858-9110
Fax: (919) 858-8669

**U.S. Southeast – Florida/ South America**
Phone: (727) 799-8406
Fax: (727) 799-8306

**U.S. Mid-Atlantic – Pennsylvania**
Phone: (215) 244-6784
Fax: (215) 244-9292

**Canada – Ontario**
Phone: (613) 271-2358
Fax: (613) 271-2359

**Europe**

**Europe Central – Germany**
Phone: +49 89 829-1320
Fax: +49 89 834-2734

**Europe North – England**
Phone: +44 1344 486444
Fax: +44 1344 486555

**Europe – Israel/Greece**
Phone: +972 9 9524000
Fax: +972 9 9573732

**Europe South – France**
Phone: +33 1 41 44 36 51
Fax: +33 1 41 44 36 90

**Europe Mediterranean – Italy**
Phone: +39 02 93179911
Fax: +39 02 93179913

**Europe – Sweden**
Phone: +46 (0) 8 5091 4319
Fax: +46 (0) 8 590 041 10

**Europe – Finland**
Phone: +358 (0) 9 85 666 435
Fax: +358 (0) 9 85 666 220

**Asia – Pacific**

Taiwan
Phone: (886-2) 2-720-0282
Fax: (886-2) 2-757-6760

**Australia**
Phone: (61-2) 9869 4088
Fax: (61-2) 9869 4077

**China – Central**
Phone: 86-21-6361-2515
Fax: 86-21-6361-2516

**China – South**
Phone: (852) 2 827-0181
Fax: (852) 2 827-6488

**China – South (Satellite)**
Phone: (86) 755-518-2495

**China – North**
Phone: (86-10) 8529-9777
Fax: (86-10) 8529-9778

**India**
Phone: (91-11) 692-4789
Fax: (91-11) 692-4712

**Korea**
Phone: (82-2) 565-2880
Fax: (82-2) 565-1440

**Korea (Satellite)**
Phone: (82-53) 745-2880
Fax: (82-53) 745-1440

**Singapore**
Phone: (65) 737 7355
Fax: (65) 737 9077

**Japan**
Phone: (81-3) 5371 1520
Fax: (81-3) 5371 1501

**www.conexant.com**